File E190233
Project 04NK20337

October 1, 2004

REPORT

on

PROGRAMMABLE CONTROLLERS FOR USE IN HAZARDOUS LOCATIONS

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DESCRIPTION

PRODUCT COVERED:

[USL][CNL] Programmable Controller, CWM-EFM-2 followed by 000, 121, 122, 123, 132, 141, 142, 202 or 204, followed by 0, 1 or 2, followed by 1 or 2, followed by 1 or 2, followed by 01, followed by 0 or 3, followed by 0 or 1, followed by 0, 1, 2 or 3, followed by 0, 1, 2 or 3, followed by 0 or 1, followed by 00, 01, 02, 03, 04, 05, 06 or 07, followed by 00, 01, 02, 03, 04, 05, 06 or 07, followed by 0 or 1, followed by 0 or 1, followed by 0, 11 or 22, followed by additional suffixes for use in Class I, Division 2, Groups A, B, C, and D Hazardous Locations.
Programmable Controller, CWM-GFC-2 followed by 000, 121, 122, 123, 132, 141, 142, 202 or 204, followed by 0, 1 or 2, followed by 1 or 2, followed by 1, followed by 01, followed by 01, 02, 03, 04, 05 or 06, followed by 0 or 1, followed by 0, 1, 2 or 3, followed by 0, 1, 2 or 3, followed by 0, 1, 2 or 3, followed by 0 or 1, followed by additional suffixes for use in Class I, Division 2, Groups C and D Hazardous Locations.

Programmable Controller, CWM-GFC-T4 followed by 000, 121, 122, 123, 132, 141, 142, 202 or 204, followed by 014, 020, 022, 023, 025 or 028, followed by 0, 1 or 2, followed by 1, 2 or 3, followed by 1 or 2, followed by 1, followed by 0 or 1, followed by 1, 2, 3, 4, 5 or 6, followed by 0, 1 or 2, followed by 0, 1, 2 or 3, followed by 0, 1, 2 or 3, followed by 0, 1, 2 or 3, followed by additional suffixes for use in Class I, Division 2, Groups C and D Hazardous Locations.

Programmable Controller, CWM-GFC-T4P followed by 000, 121, 122, 123, 132, 141, 142, 202 or 204, followed by 0, 1 or 2, followed by 1 or 2, followed by 1 followed by 0, 1, 2 ,or 3, followed by 0, 1, 2 or 3, followed by 0 or 1, followed by 0, 1, 2 or 3, followed by 0, 1, 2 or 3, followed by 0 or 1, followed by 0, 1, 2, or 3, followed by 0 or 1 followed by 0,1, or 2, followed by 0, 1, or 2 followed by 000, 001, 103, 104,201, 202,301, 310, 311,320, 321, 322, 401, 402, 403, 404, 420, 421, 422, 423 additional suffixes for use in Class I, Division 2, Groups C, and D Hazardous Locations.

Programmable Controller, Control Wave Express PAC followed by 1, 2 or 3, followed by 1, 2, 3, 4, 5 or 6, followed by 11, 12, 13, 14, 15 or 16, followed by 0, 1, 2 or 3, followed by 0, 1 or 2, followed by 00 or 01, followed by 0, 1 or 2, followed by additional suffixes for use in Class I, Division 2, Groups C and D Hazardous Locations.
Programmable Controller, CW-Express followed by 1 or 2, followed by 0, 1 or 2, followed by 11, 12, 13, 14, 15 or 16, followed by 0, 1, 2 or 3, followed by 00, followed by additional suffixes for use in Class I, Division 2, Groups A, B, C, and D Hazardous Locations.

Programmable controller, CWM-GFC-TC followed by 014, 020, 022, 023, 025, or 028, followed by 1, 2, or 3, followed by 0 or 1, followed by 1, followed by 0, 1, or 3, followed by 1, 2, 3, 4, 5, or 6, followed by 0 or 1, followed by 0, 1, 2, or 3, followed by 0, 1, 2, or 3, followed by 0, 1, 2, or 3, followed by 00, 13, 11, 12, 14, 23, 21, 22, or 24, followed by 000, 001, 103, 104, 201, 202, 301, 310, 311, 320, 321, 322, 401, 402, 403, 404, 420, 421, 422, or 423, followed by 0, 1, or 2, followed by 0, 1, or 2, followed by 0, 1, or 2, followed by 0, 1, 2, or 3, followed by 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 for use in Class I, Division 2, Groups C and D Hazardous Locations.

GENERAL:

The CWM-EFM-2 is an enclosed device that employs a scalable, modular hardware design. Units contain a base backplane that supports 2 or 6 I/O modules. An expansion backplane can be added to the base backplane providing an additional 2, 4 or 8 I/O Modules. Each ControlWave Micro Process Automation Controller is comprised of a Backplane Board (mounted in the Chassis), a Power Supply Module, a CPU Module and from 0 to 14 I/O modules. All system modules plug into the Backplane Board (2 I-O slot base, 6 I-O slot base, or 2, 4, 8 I/O expansion backplanes). Each I/O Module provides the circuitry and field interface hardware necessary to interconnect the assigned field I/O circuits. CPU Board implements a 6 status LEDS. Power is generated and regulated by the Power Supply/Sequencer Module that provides +3.3 V dc. The digital input isolated card provides an isolated 21 VDC for contact closure.

The CWM-GFC-2 is a scaled down version of the CWM-EFM-2.

The CWM-GFC-T4, Control Wave Express PAC, and CW-Express are scaled down, cost-effective versions of the CWM-GFC-2, with identical differential/gauge pressure ranges, power systems, RTD, RTD Thermowell options, RF Communication options, and RF Radio options as the CWM-GFC-2. The three models have identical I/O Modules. The CWM-GFC-T4 and Control Wave Express PAC are housed in identical enclosures as the CWM-GFC-2 and are similar except for a CPU option on the Control Wave Express PAC and differential/gauge pressure sensors (wet end) on the CWM-GFC-T4. The CW-Express has an identical CPU option as the Control Wave Express PAC, but is an open-type device and housed in a sheet metal enclosure.

The CWM-GFC-T4P uses the electronics of the CWM-GFC-T4 with the enclosure and power systems of the CWM-EFM-2.

The CWM-GFC-TC is similar in design to the CWM-GFC-T2. The CWM-GFC-TC employs a gauge pressure sensor similar to the one used on the CWM-GFC-T2 except for the presence of one sensor on the transducer instead of two, the absence of a differential chip, and a ½" female NPT process connection instead of a ½" male NPT process connection. The CWM-GFC-TC also employs a pulse counter.

ENGINEERING CONSIDERATIONS (NOT FOR FIELD REPRESENTATIVE USE):

Products designated USL have been investigated using requirements contained in UL 1604” Electrical Equipment for Use in Class I and II, Division 2 and Class III Hazardous Locations” and UL508 “Industrial Control Equipment”. The CWM-GFC-TC has also been investigated using requirements contained in ISA 12.12.01-2000, “Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous Locations, approved 6 April 2001.

Products designated CNL have been investigated using requirements contained in Canadian Standards C22.2 No. 213-M1987 “Non-incendive Electrical Equipment for Use in Class I, Division 2 Hazardous Locations” and C22.2 No. 142-M1987 “Process Control Equipment”.

RATINGS:

Electrical

External Source - 12 V dc, 700 mA (CWM-EFM-2).
12 V dc, 50 mA (CWM-GFC-2).
12 V dc, 15 mA (CWM-GFC-T4).
12 V dc, 15 mA (CWM-GFC-T4P).
12 V dc, 15 mA (CWM-GFC-TC).
24 V dc, 50 mA (Control Wave Express PAC).
24 V dc, 50 mA (CW-Express).

Environmental

Surrounding Air Temperature - 70° maximum
Type 1 (CWM-EFM-2, CWM-GFC-2, CWM-GFC-T4,Control Wave Express PAC, CWM-GFC-TC)
Open Type (CW-Express), CWM-GFC-T4P

MARKING:

The following markings are provided:

1. **Manufacturer's name, module number, ratings, "Class I, Div. 2, Groups A, B, C, D" or “Class I, Div. 2, Groups C and D” as in Product Covered section of the report and " Surrounding Air Temperature 70°C".**
2. Located near supply terminals, "Warning - Explosion Hazard - Do Not Disconnect While Circuit Is Alive Unless Area Is Known to Be Non-Hazardous".
3. Date Code of Manufacturer - provided by Serial number.
4. Temperature Code – T4
5. Located near battery, “Warning – Explosion Hazard – Do Not Disconnect The Battery Unless The Area Is Known To Be Non-Hazardous”.
6. Battery Types or Model number
7. **CWM-GFC-TC shall be marked with “Power Supplied by Class 2 Source” on the device and the installation instructions specifying the use of a Class 2 source.**

NOMENCLATURE:

See ILL. 14 (CWM_EFM-2), ILL. 15 (CWM-GFC-2), ILL. 16 (CWM-GFC-T4), ILL. 17 (Control Wave Express PAC), ILL. 18 (CW-Express), Ill 19 (CWM-GFC-T4P), and ILL. 20 (CWM-GFC-TC) for details.

INSTALLATION INSTRUCTIONS:

Installation and operating instructions are provided with each device. Installation instructions should contain statement that input and output (I/O) wiring must be in accordance with Class I, Div. 2 wiring methods and in accordance with the authority having jurisdiction.

The following shall be provided:

1. **"The Equipment is suitable For Use in Class I, Division 2, Groups A, B, C, D or Non-Hazardous Locations Only" or "Class I, Div. 2, Groups C and D or Non-Hazardous Locations Only".**

2. "Warning - Explosion hazard - Substitution of components May Impair Suitability for Class I, Division 2".

3. "Warning - Explosion Hazard - Do Not Disconnect Equipment Unless Power Has Been Switched Off Or The Area is Known To Be Non-Hazardous".

CONSTRUCTION DETAILS:

The Programmable Controller Modules are described in accordance with the following:

Fig. No.		Ill No.	Manufacturer's Drawing No.	Rev level	Description
1					CWM-EFM-2 External View
2					CWM-EFM-2 Internal View
3					CWM-GFC-2 External View
4					CWM-GFC-2 Internal View
5					CWM-GFC-T4/Control Wave Express PAC External View
6					CWM-GFC-T4/Control Wave Express PAC Internal View
7					CW-Express External View w/ cover
8					CW-Express External View w/o Cover
9					CW-Express Internal View
10					CWM-GFC-T4P
11					**CWM-GFC-TC External Front View**
12					**CWM-GFC-TC External Side View**
13					**CWM-GFC-TC Internal View**
		1	3808-30A	A	3808 Differential Pressure Transmitter Report (pages 1-3)
		2	721700-01-2	A	CWM-EFM-2 Radio Ready Drawing (pages 1-8)
		2A	**721700-02-0**	**A**	**CWM-GFC-2, CWM-GFC-T4, CWM-GFC-TC, and Control Wave Express PAC Radio Ready Drawing (pages 1-9)**
		3	396618-01-4	A	CWM-EFM-2 Back Plate
		3A	396662-01-3	B	CWM_GFC-2 Back Plate
		3B	**396815-01-4**	**A**	**CWM-GFC-T4, CWM-GFC-TC, and Control Wave Express PAC Back Plate**
		4	392582-00-7	A	Relay Assembly
		5	392582-B/M	A	Relay Parts List
		6	392949-00-8	A	Power Distribution Assembly
		7	392949-01-6	C	Power Distribution Parts List
		8	396627-00-5	A	CWM-EFM-2 Radio Final Assembly (pages 1-5)
		8A	396661-00-9	B	CWM-GFC-2 Radio Final Assembly (pages 1-4)
		8B	**396829-00-7**	**A**	**CWM-GFC-T4, CWM-GFC-TC, and Control Wave Express PAC Final Assembly**
		8C	396828-00-0	A	CW-Express Final Assembly
		9	400074-75-3	A	CPU Module Assembly
		9A	**400094-75-4**	**A**	**CWM-GFC-T4, CWM-GFC-TC, Control Wave Express, and CW-Express PCB Assembly CPU/SC**
		10	400074-02-8	C	CPU Module Parts List
		10A	**400094-01-0**	**C**	**CWM-GFC-T4 GFC I and CWM-GFC-TC CPU Parts List**
*					

Fig. No.		Ill No.	Manufacturer's Drawing No.	Rev level	Description
		10B	**400094-02-9**	**F**	**Control Wave Express PAC and CW-Express GFC II CPU- Ultra Low Power - Parts List**
		10C	**400094-03-7**	**E**	**Control Wave Express PAC and CW-Express RTU I CPU- Low Power w/o Ethernet - Parts List**
		10D	**400094-04-5**	**D**	**Control Wave Express PAC and CW-Express RTU II CPU - w/ Ethernet-Parts List**
		11	396665-01-2	A	Modified FiBox enclosure
		12	396663-01-0	A	Battery Bracket
		13	396664-01-6	A	Radio Bracket
		13B	**396664-01-6**	**C**	**CWM-GFC-T4, CWM-GFC-TC, and Control Wave Express Radio Bracket**
		14	CWM-EFM-2	M	Model Specification
		15	CWM-GFC-2	C	Model Specification
		16	CWM-GFC-T4	A	Model Specification
		17	Control Wave Express PAC	A	Model Specification
		18	CW-Express	A	Model Specification
		19	CW-Express CWM-GFC-T4P	A	Model Specification
		20	**CWM-GFC-TC**	**A**	**Model Specification**

Spacing - Spacing of non-Class 2 circuits are not less that 1.6 mm through air and 3.2 mm over surface, maintained between an uninsulated live part and uninsulated live part of opposite polarity, uninsulated grounded part, or exposed metal part. Spacings are not specified in the secondary circuits of the power supplies and modules.

Tolerances – Unless specified otherwise, all indicated dimensions are nominal.

Corrosion Protection – All parts are of corrosion resistant material or are plated or painted as corrosion protection.

Edge and Wire Connectors – All connectors are provided with means for mechanically latching all mating plugs and receptacles unless otherwise indicated.

CWM-EFM-2 EXTERNAL VIEW – FIG. 1

* General - The interconnections between the System Controller Module (Slot 1) and the RTD probe was evaluated as nonincendive field circuits. All other interconnections with external devices are in accordance with Division 2 wiring methods as specified in the National Electrical Code, NFPA 70.

1. Enclosure – Listed (NITW) polymeric enclosure, measuring a minimum of 14.5 x 12.5 by 8.25 in. Type 1 only.

2. Pressure Transducer – Type 316 stainless steel mounted to the diaphragm unit by welding. Transducer contains two sensors made up of a piezo-resistive strain gauge and differential chip embedded inside with only wire leads protruding, and is sealed by epoxy on each connector. Internal diaphragm is filled with DC200 Silicone Fluid.

   Part No. 396531-01-6, -02-4, -03-2, -04-0, -05-9, -06-7, -07-5. See ILL. 1 (pages 1-3) for further details.

4. RTD – (Optional) Resistive element connected to the System Controller Module (396609-02-3, 396609-01-5) via a three-conductor cable. Cable maximum length of 25 ft. RTD Thermowell can be provided allowing the RTD to plug into the pipeline.

5. RF Antenna Connector – Used for connection to remote antenna assembly. N Type connector, latching.

6. Display Module – R/C (ZPMV2), rated minimum 105°C, 94V-0. Plugs into the system's Power Supply Module (connector J2) via connector J1. The following are make/break components.

   Potentiometer (R67) - Provided on the secondary side of the power supply and within a nonincendive circuit.

   Pushbuttons (PB1, PB2) – (396608-01-9) Provided on the secondary side of the power supply and within a nonincendive circuit.

   Pushbuttons (PB1 – PB25) – (396608-02-7) Provided on the secondary side of the power supply and within a nonincendive circuit.

CWM-EFM-2 INTERNAL VIEW – FIG. 2

General – Power is from an external source, 6-18 VDC. Radio ready feature may be provided when installed in accordance with the instructions provided in ILL. 2 (Drawing No. 721700-01-2).

1. Back Plate – Steel mounting plate that secures all internal equipment. See ILL. 3 (396618-01-4) for further details.

2. Chassis - Listed (NRAG), Module 396560-02-4. Consists of 4 slots configured as follows:

   Slot 1 – Listed (NRAG), 396609-02-3, 396609-01-5

   Slot 2 – Listed (NRAG), 396563-03-1

   Slot 3 – Listed (NRAG), 396630-01-4, 396630-02-2, 396567-01-0, 396568-01-7, 396569-01-3, 396570-02-0, 396581-01-3

   Slot 4 - Listed (NRAG), 396630-01-4, 396630-02-2, 396567-01-0, 396568-01-7, 396569-01-3, 396570-02-0, 396581-01-3

3. Relay Board - R/C (ZPMV2), rated minimum 105°C, 94V-0. Overall dimensions 5-1/16 in. by 2-3/4 in. Slides into a plastic piece, which secures to inside of enclosure by four screws. Connects to I/O Card (Item 2, Slot 3 or 4) through twenty-pin connector. Refer to ILLS. 4-5 (392582-00-7, 392582-B/M).

4. Power Distribution Board – (Optional) R/C (ZPMV2), rated minimum 105°C, 94V-0. See ILLS. 6-7.

5. Radio – (0ptional) Suitable for Class I, Division 2, Groups A, B, C and D Hazardous Locations. When provided as an external connection, must consist of a mounting bracket, communication cable, antenna cable, power cable. See ILL. 8 (396627-00-5) for further details.

   R/C (WYMV2), MDS, Models 9810-HL, 4710-HL, 9710-HL and EL805 (Transnet Series) and INET (iNet Series). Secured to metal plate, which is then secured to back plate. See ILL. 13 (396664-01-6) for further details. Must receive main power from latching connector.

   R/C (ENWS2), FreeWave, Model FGR09CSU. Secured to metal plate, which is, in turn, secured to back plate. See ILL. 13 (396664-01-6) for further details. Must receive main power from latching connector.

CWM-GFC-2 EXTERNAL VIEW – FIG. 3

* General - The interconnections between the CPU Module (P3) and the RTD probe was evaluated as nonincendive field circuits. All other interconnections with external devices are in accordance with Division 2 wiring methods as specified in the National Electrical Code, NFPA 70.

1. Enclosure – Listed (NITW) polymeric enclosure, manufactured by FiBox, Part No. CAB PC 302018. Type 1 only. See ILL. 11 for modifications.

2. Pressure Transducer – Type 316 stainless steel mounted to the diaphragm unit by welding. Transducer contains two sensors made up of a piezo-resistive strain gauge and differential chip embedded inside with only wire leads protruding, and is sealed by epoxy on each connector. Internal diaphragm is filled with DC200 Silicone Fluid.

   Part No. 396531-01-6, -02-4, -03-2, -04-0, -05-9, -06-7, -07-5. See ILL. 1 (pages 1-3) for further details.

3. RTD – (Optional) Resistive element connected to the System Controller Module (396609-02-3, 396609-01-5) via a three-conductor cable. Cable maximum length of 25 ft. RTD Thermowell can be provided allowing the RTD to plug into the pipeline.

4. RF Antenna Connector – Used for connection to remote antenna assembly. N Type connector, latching.

5. Display Module - R/C (ZPMV2), rated minimum 105°C, 94V-0. Plugs into the CPU Module (connector P2). The following are user accessible make/break components.

   Potentiometer (R67) - Provided on the secondary side of the power supply and within a nonincendive circuit.

   Pushbuttons (PB1, PB2) – (396608-01-9) Provided on the secondary side of the power supply and within a nonincendive circuit.

   Pushbuttons (PB1 – PB25) – (396608-02-7) Provided on the secondary side of the power supply and within a nonincendive circuit.

CWM-GFC-2 INTERNAL VIEW – FIG. 4

General – Power is from an external source, 6-18 VDC. Radio ready feature may be provided when installed in accordance with the instructions provided in ILL. 2A (Drawing No. 721700-02-0).

1. Back Plate – Steel mounting plate that secures all internal equipment. See ILL. 3A (396662-01-3) for further details.

2. CPU Module – R/C (ZPMV2), rated minimum 105°C, 94V-0. See ILLS. 9 (400074-75-3) and 10 (400074-02-8) for further details.

   The following are make/break components within a nonincendive circuit protected by a ½ Amp fuse located on the I/O Module.

   Potentiometer (R164)
   Jumpers (W2-W5, W7-W13, W15-W16, W19-W22, W25, W28)

   The following are make/break components within a nonincendive circuit protected by 100 Kohm resistors.

   Switches (SW1-SW4)
   Jumpers (J2, J14)

   The following are make/break components provided with a tie-wrap to prevent disconnection.

   Jumpers (J7, J8, J10, J11)

3. Modem – (Optional) R/C (NWGQ2), manufactured by Multi-Tech, Model MT5634SMI-ITP. Plugs directly into CPU Module (J7, J8, J10, J11).

4. Radio – (0ptional) Suitable for Class I, Division 2, Groups A, B, C and D Hazardous Locations. When provided as an external connection, must consist of a mounting bracket, communication cable, antenna cable, power cable. See ILL. 8A (396661-01-1) for further details.

   R/C (WYMV2), MDS, Models 9810-HL, 4710-HL, 9710-HL and EL805 (Transnet Series) and INET (iNet Series). Secured to metal plate, which is then secured to back plate. See ILL. 13 (396664-01-6) for further details. Must receive main power from latching connector.

   R/C (ENWS2), FreeWave, Model FGR09CSU. Secured to metal plate, which is, in turn, secured to back plate. See ILL. 13 (396664-01-6) for further details. Must receive main power from latching connector.

5. I/O Modules – R/C (ZPMV2), rated minimum 105°C, 94V-0. Fits into card guide located on base plate. There are four available options:

400073-04-8: 2 DI, 2DO, 2HSC, Wet End (12 VDC)
400073-03-0: 2 DI, 2DO, 2HSC, Wet End, 3 AI, 1 AO (12 VDC)
400073-02-1: 2 DI, 2DO, 2HSC, Wet End (6 VDC)
400073-01-3: 2 DI, 2DO, 2HSC, Wet End 3 AI (6 VDC)

The following are make/break components within a nonincendive circuit protected by 100 Kohm resistors.

Jumpers (J2, J7, J8, J10, J11, J14)

CWM-GFC-T4 EXTERNAL VIEW – FIG. 5

General - The interconnections between the CPU Module (P3) and the RTD probe was evaluated as nonincendive field circuits. All other interconnections with external devices are in accordance with Division 2 wiring methods as specified in the National Electrical Code, NFPA 70.

1. Enclosure – Identical to Item 1 under CWM-GFC-2, Fig. 3.

2. Pressure Transducer – Type 316 stainless steel mounted to the diaphragm unit by welding. Transducer contains two sensors made up of a piezo-resistive strain gauge and differential chip embedded inside with only wire leads protruding, and is sealed by epoxy on each connector. Internal diaphragm is filled with DC200 Silicone Fluid.

   Part No. 396531-01-6, -02-4, -03-2, -04-0, -05-9, -06-7, -07-5. See ILL. 1 (pages 1-3) for further details.

3. Gauge Pressure Sensor – Same as Item 2 above except with ½" male NPT process connection.

   Part No. 396536-02-6, 396536-04-2, 396536-06-9, 396536-07-7, 396536-09-3, 396536-12-3.

4. RTD – (Optional) Identical to Item 3 under CWM-GFC-2, Fig. 3.

5. RF Antenna Connector – Identical to Item 4 under CWM-GFC-2, Fig. 3.

6. Display Module – Identical to Item 5 under CWM-GFC-2, Fig. 3.

CWM-GFC-T4 INTERNAL VIEW – FIG. 6

General – Power is from an external source, 5-18 VDC. Radio ready feature may be provided when installed in accordance with the instructions provided in ILL. 2A (Drawing No. 721700-02-0).

1. Back Plate – Steel mounting plate that secures all internal equipment. See ILL. 3B for further details.

2. CPU Module – R/C (ZPMV2), rated minimum 105°C, 94V-0. See ILLS. 9A (400094-75-4) and ILL. 10A (400094-01-0) for further details.

   The following are make/break components within a nonincendive circuit protected by 100 Kohm resistors.

   Switches (SW1-SW2)

   The following are make/break components within a nonincendive circuit protected by a 1.3 Kohm resistor.

   Switch (SW3)

   The following are make/break components within a nonincendive circuit that are not accessible unless the power to the device is turned off and the boards are removed from the enclosure.

   Jumpers (J2, J3)
   Jumper Plug (XW1-XW17)
   Autosplice Pin (W1-W17 and J7-J9)

3. Modem – (Optional) Identical to Item 3 under CWM-GFC-2, Fig. 4.

4. Radio – (0ptional) Suitable for Class I, Division 2, Groups A, B, C and D Hazardous Locations. When provided as an external connection, must consist of a mounting bracket, communication cable, antenna cable, power cable. See ILL. 8B (396829-00-7) for further details.

   R/C (WYMV2), MDS, Models 9810-HL, 4710-HL, 9710-HL and EL805 (Transnet Series) and INET (iNet Series). Secured to metal plate, which is then secured to back plate. See ILL. 13B (396664-01-6) for further details. Must receive main power from latching connector.

   R/C (ENWS2), FreeWave, Model FGR09CSU. Secured to metal plate, which is, in turn, secured to back plate. See ILL. 13B (396664-01-6) for further details. Must receive main power from latching connector.

5. I/O Modules – R/C (ZPMV2), rated minimum 105°C, 94V-0. Fits into card guide located on base plate. There are three available options:

400093-01-4: 2 DI/2DO, 4DI, 2 DO, 2HSC
400093-02-2: 2 DI/2DO, 4DI, 2 DO, 2HSC, 3 Al
400093-03-0: 2 DI/2DO, 4DI, 2 DO, 2HSC, 3 Al, 1 AO

The following are make/break components within a nonincendive circuit protected by 100 Kohm resistors.

Switch (SW1)

The following are make/break components within a nonincendive circuit that are not accessible unless the power to the device is turned off and the boards are removed from the enclosure.

Autosplice Pin (J1, JP1, JP3, JP4-JP7)
Jumper Plug (XJP1, XJP3-XJP7)

CONTROL WAVE EXPRESS PAC
EXTERNAL VIEW – FIG. 5, INTERNAL VIEW – FIG. 6

General - The Control Wave PAC is identical to the CWM-GFC-T4, but does not contain Item 2, 3, 4 (Pressure Transducer, Gauge Pressure Sensor, RTD Option) and also as noted below. Power is from an external source, 6-24 VDC.

1. CPU Modules – R/C (ZPMV2), rated minimum 105°C, 94V-0, with or without gas calculation (CPU Option). See ILLS. 9A (400094-75-4) and ILL. 10B (400094-02-9), 10C (400094-03-7), and 10D (400094-04-5) for further details.

   The following are make/break components within a nonincendive circuit protected by 100 Kohm resistors.

   Switches (SW1-SW2)

   The following are make/break components within a nonincendive circuit protected by a 1.3 Kohm resistor.

   Switch (SW3)

   The following are make/break components within a nonincendive circuit that are not accessible unless the power to the device is turned off and the boards are removed from the enclosure.

   Modular Connector (J2)
   Socket (J3)
   Connector (J4)
   Jumper Plug (XW1-XW17)
   Autosplice Pin (W1-W17 and J5-J9)

CW-EXPRESS
EXTERNAL VIEW – FIG. 7 AND 8
INTERNAL VIEW – FIG. 9

General - The CW-Express is an open-type device that consists of identical CPU Modules as the Control Wave Express PAC and identical I/O Modules as the CWM-GFC-T4 and Control Wave Express PAC. Mounting instructions are provided in the installation manual for the end user to mount the device in a Type 1 enclosure. Power is from an external source, 6-24 VDC. See ILL. 8C for the final assembly drawing.

1. Enclosure – Aluminum sheet metal. 10-3/4 by 5-1/2 by 2.0 in.

2. CPU Modules – Identical to Item 1 under Control Wave Express PAC, Figs. 5 and 6.

3. I/O Modules – Identical to Item 5 under CWM-GFC-T4, Fig 6.

CWM-GFC-TC EXTERNAL VIEW – FIG. 11, 12
CWM-GFC-TC INTERNAL VIEW – FIG. 13

General - The interconnections between the CPU Module (P3) and the RTD probe was evaluated as nonincendive field circuits based on similar construction of model CWM GFC-2 in Fig. 3. All other interconnections with external devices are in accordance with Division 2 wiring methods as specified in the National Electrical Code, NFPA 70. Internal components identical to Fig. 6, with the exception of the items below.

1. Enclosure – Identical to Item 1 under CWM-GFC-2, Fig. 3.

2. Gauge Pressure Sensor – Type 316 stainless steel mounted to the diaphragm unit by welding. Transducer contains one sensor made up of a piezo-resistive strain gauge embedded inside with only wire leads protruding, and is sealed by epoxy on each connector. Internal diaphragm is filled with DC200 Silicone Fluid. Process connection is 1/2" female NPT. Part No. 396865-02-0, 396865-04-6, 396865-06-2, 396865-07-0, 396865-09-7, 396865-12-7.

3. RTD – (Optional) Identical to Item 3 under CWM-GFC-2, Fig. 3.

4. RF Antenna Connector – Identical to Item 4 under CWM-GFC-2, Fig. 3.

5. Display Module – Identical to Item 5 under CWM-GFC-2, Fig. 3.

6. Pulse Counter – P/N 396300-01-4, 396300-02-2. Identical to Pulse Counter in Telecorrector File E165662, Vol. 1 Sec. 2.

1 W, 6 V SOLAR PANEL SYSTEM OPTION

General – Only used on CWM-GFC-2. When the solar power system described below is used, the solar panel system described on page 10 is not provided.

1. Cable - Two insulated conductors. Maximum cable length is 25 ft. Provided with connector, which plugs into terminal block on the computer board.

2. Solar Panel - Solarex Corp. Type MSX-01 photovoltaic module, polycarbonate frame (Lexan) measures 6-1/4 by 5-1/2 by 3/8 in. thick. Externally mounted to a provided pole. The electrical ratings are as follows:

Current at maximum power, mA	150
Voltage at maximum power, V	7.5

Alternate Solar Panel - Siemens Model BT18141B, rated 6 V, 1 W.

3. Battery - R/C (BZZR2), sealed cell lead-acid rechargeable battery. Rated 6 V, 7 Ah maximum. The lead wires are mechanically secured to the battery terminals. The other end of the battery leads are secured to a connector which plugs into a terminal block on the computer board. The battery resides in an aluminum bracket as shown in ILL. 12, which is secured to the inside back of the enclosure by screws.

Alternate - Same as above, except additionally provided with single lithium battery pack, R/C (BBBCV2) manufactured by Tadiran, Model TL-5137.

5 W, 6 V SOLAR PANEL SYSTEM OPTION

General - This system consists of the 5 W solar panel shown on page 10 and the 6 V lead acid battery shown on page 8. When this system is used, the solar panel systems described on page 8 and 10 are not provided.

1. Cable - Two insulated conductors. Maximum cable length is 25 ft. Provided with connector, which plugs into terminal block on the computer board.

2. Solar Panel - Solarex Corp., Type MSX-5/6 photovoltaic module, polycarbonate frame (Lexan) measures 9.82 by 10.60 by 0.88 in. thick. Externally mounted to a provided pole. The electrical ratings are as follows:

Current at maximum power, mA	460
Voltage at maximum power, V	10.3

Alternate Solar Panel - Same as above, except Type MSX5-1.

Current at maximum power, mA	0.59
Voltage at maximum power, V	8.5

Alternate Solar Panel - Showa Model GT618F, rated 6 V, 4.3 W.

Alternate Solar Panel - Same as above, except any solar panel approved for Class I, Div. 2 Hazardous Locations with the following parameters.

VOC = 10.25 VDC±10%
ISC = 0.56 ADC±10%

3. Battery - R/C (BZZR2), sealed cell lead-acid rechargeable battery, rated 6 V, 7 Ah maximum. The lead wires are mechanically secured to the battery terminals. The other end of the battery leads are secured to a connector, which plugs into a terminal block on the computer board. The battery resides in an aluminum bracket as shown in ILL. 12, which is secured to the inside back of the enclosure by screws.

Alternate - Same as above, except additionally provided with with single lithium battery pack, R/C (BBBCV2) manufactured by Tadiran, Model TL-5137.

5 W, 12 V SOLAR PANEL SYSTEM OPTION

General - When the solar power system described below is used, the solar power system described on page 8 is not provided.

1. Cable - Two insulated conductors within an outer jacket. Maximum cable length is 25 ft. Provided with connector which plugs into terminal block on the computer board.

2. Solar Panel - Solarex Corp. Type SA5 photovoltaic module, polycarbonate frame (Lexan) measures 3-1/2 by 13-1/2 by 3/4 in. thick. Externally mount to a provided pole. The electrical ratings are as follows:

Current at maximum power, mA	330
Voltage at maximum power, V	15

Alternate Solar Panel - Same as above except any solar panel approved for Class I, Div. 2 Hazardous Locations with the following parameters.

VOC = 20.5 VDC±10%
ISC = 0.28 ADC±10%

3. Battery - Recognized Component (BAZR2), sealed cell lead-acid rechargeable battery. Rated 12 V, 7 Ah maximum. The lead wires are mechanically secured to the battery terminals. The other end of the battery leads are secured to the a connector which plugs into a terminal block on the computer board. The battery resides in a an aluminum bracket as shown in ILL. 12, which is secured to the inside back of the enclosure by screws.

BATTERY OPTIONS

General - When one of the following battery options is used, no solar panel system is used.

1. Single Lithium Battery Pack - Consists of 2 R/C (BBCV2) cells, Tadiran Model TL-5137, in heat shrink tubing, rated 6 V, 27 Ah.

2. Dual Lithium Battery Pack - Consists of 2 single packs wired together (parallel), rated 6 V, 54 Ah.

CWM-GFC-T4P FIG 10

General – See ill 19, The CWM-GFC-T4P uses the electronics of the CWM-GFC-T4 with the enclosure and power systems of the CWM-EFM-2.